

Geo-Cultural Analysis Tool™ (GCAT)

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**DMSC
Orlando, Florida
March 10, 2008**



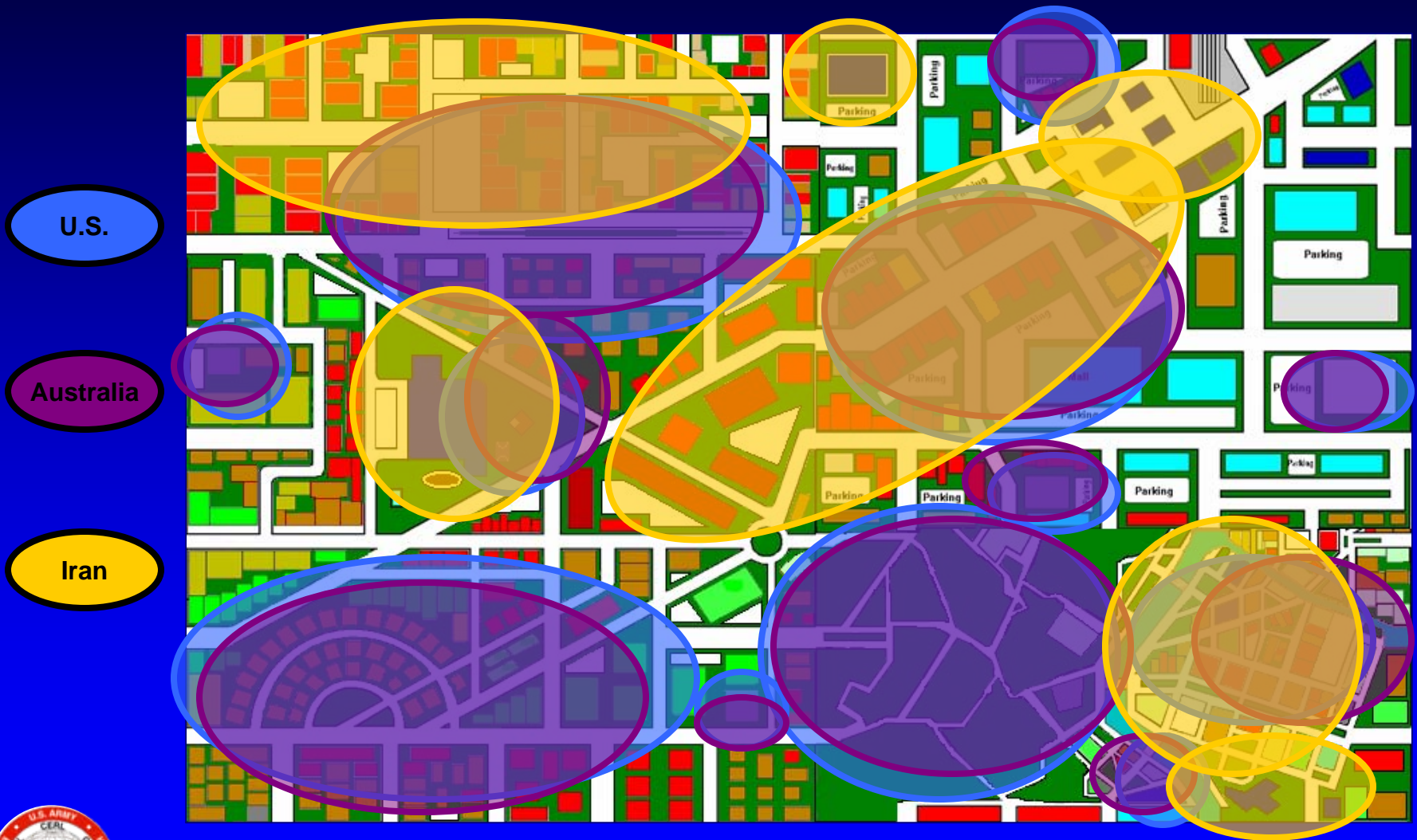
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Iran

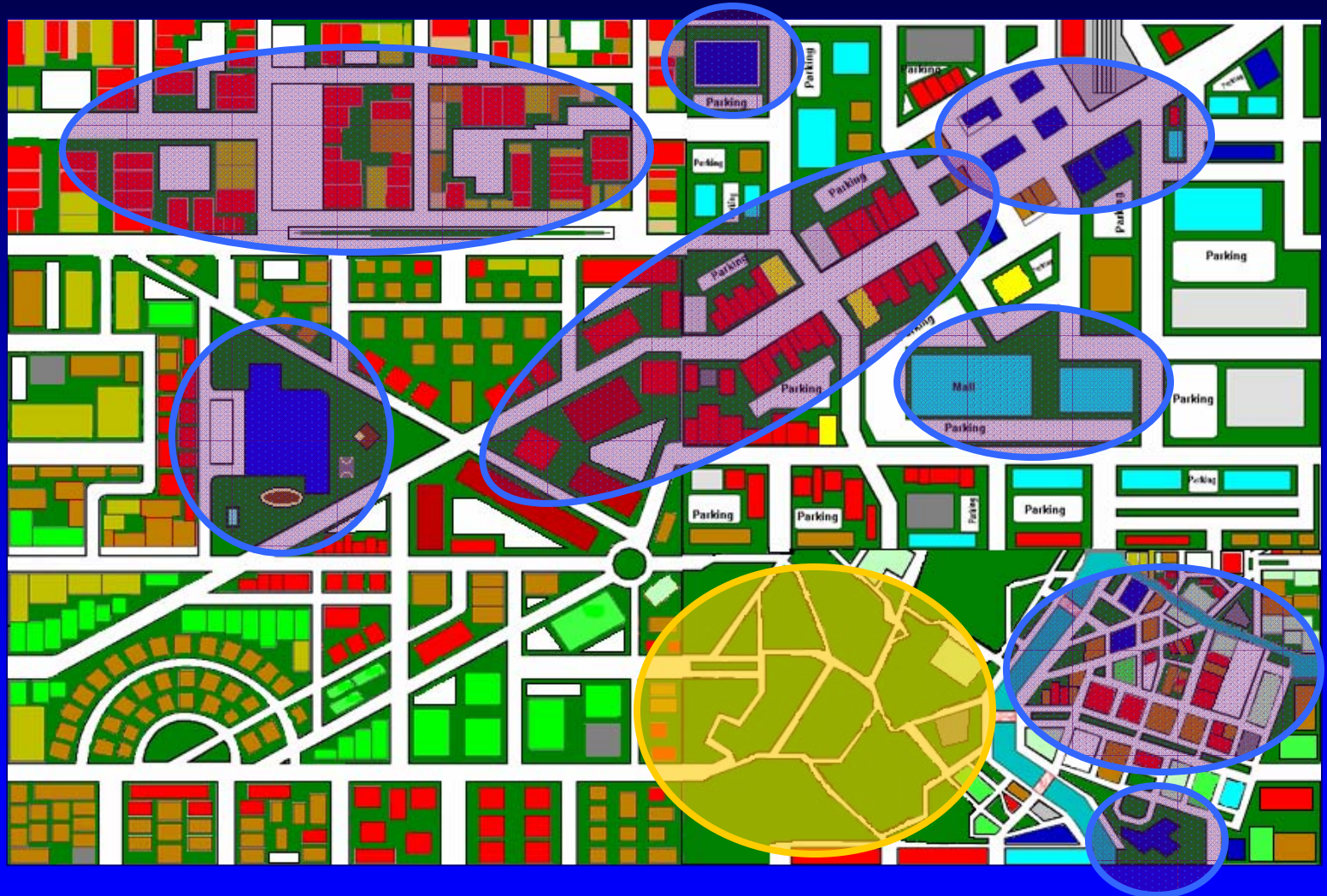


It's 1200, Sunday, October 5...



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It's 1530, Tuesday, April 1...



U.S.

Australia

Iran



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Presentation Outline

- Introduction
- Why GCAT?
- Geo-Cultural Analysis (Theory)
- Geo-Cultural Ontology (Method)
- Geo-Cultural Analysis Tool (Application)
- Future Directions
- Conclusion



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URBAN: Geo-Cultural Analysis ToolTM

- **Overview:** Cultural characterization component of NEC2/URBAN
- **Issue:** Where are people located in the urban environment at any given time/day?
- **Approach:** Use ontology enterprise system to model aggregate routine/ritual behavior using Geo-Cultural Analysis method.
- **Objective:** Geo-Cultural Analysis Tool
 - Ontology enterprise-based system
 - Web portal for prototype application
 - GIS-Based DST for final URBAN integration



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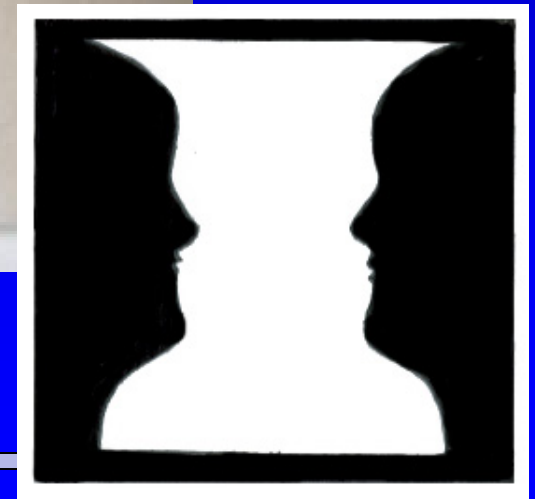
Rethinking the Urban Battlefield

“We cannot solve the problems that we have created with the same thinking that created them.”

—Albert Einstein



Ambiguous Figures and Perspective



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Urban Triad or the Vase



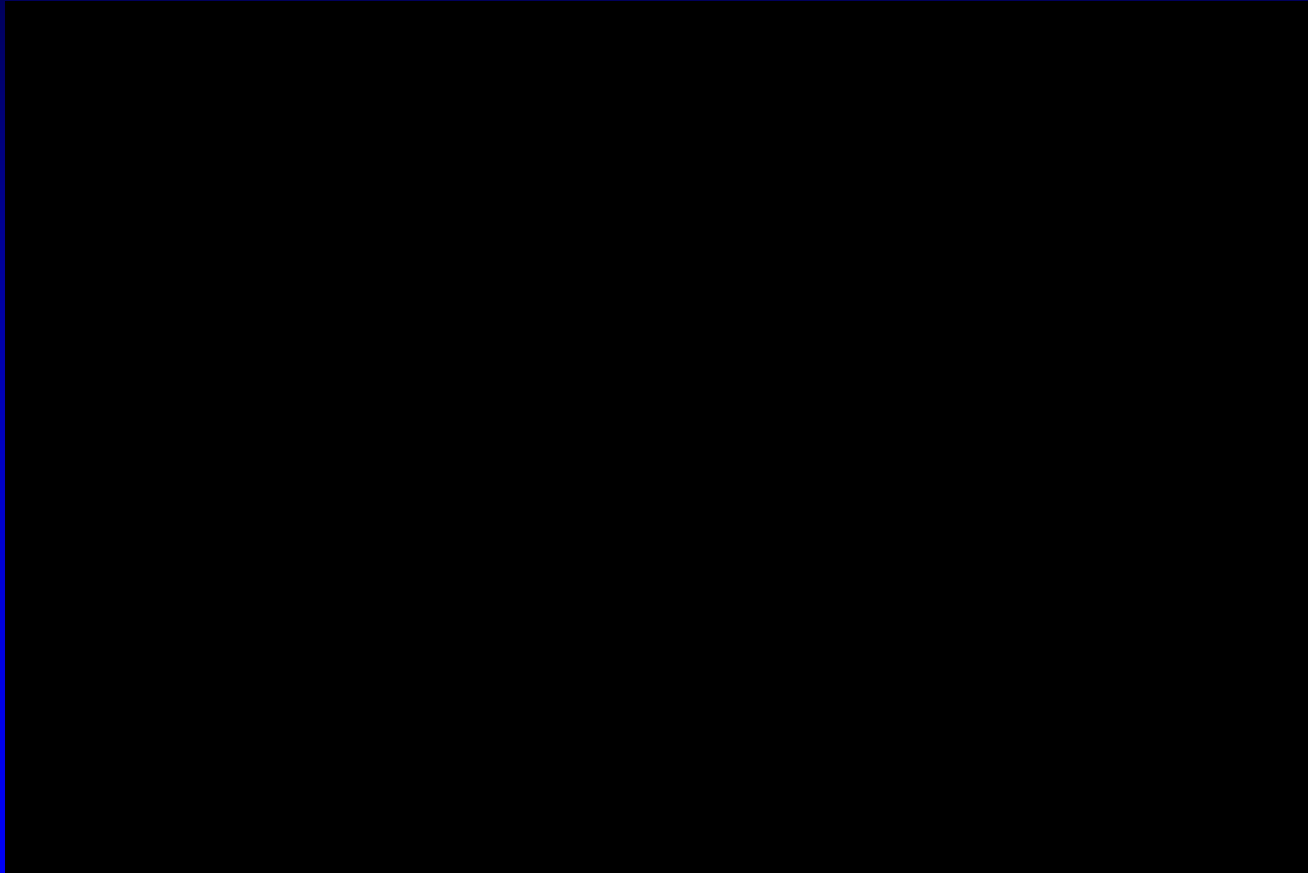
Topography + Infrastructure + Demographics



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Urban Environment

Topography + Infrastructure + **PEOPLE** (Culture/Demography/Behavior) + **TIME**



"The worst policy is to attack cities...Attack cities only when there is no alternative."

-Sun Tzu, Circa 500 BC

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Putting People Back in the Picture

- Challenge: How to accomplish this?
- GCAT Niche: Where are the people likely to be located in the urban environment at any given time/day?

*“To understand the city, one must understand patterns of activities in which urban residents singly and collectively engage. Since all human activities occur coincidentally in **space** and **time** we need to find ways of describing and explaining their **space** and **time** patterning.”*

- Proposed Solution: Geo-Cultural Analysis



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Geo-Cultural Analysis

- **Geo-Cultural Analysis (GCA):**
 - **Process of identifying how culture influences behaviors and practices that can be attributed with a spatial and temporal metric and associated with physical elements of the built environment**
 - **Derived from Time-Geography Theory, applied at cohort level, OR an ontological approach to Time-Geography**



Geo-Cultural Analysis Axioms

- **Time Geography Axioms:**
 - Every behavior/activity occurs in both space and time
 - One behavior/activity at a time
 - One person cannot be in two places at the same time
- **Chorography Axiom:**
 - Localized spaces and places will have their own form and character (cultural influence)
- **Aggregate Behavioral Axioms:**
 - Humans as social creatures are byproducts of culture
 - Humans are creatures of habit
 - Humans are territorial
 - Humans operate within a “time-budget”



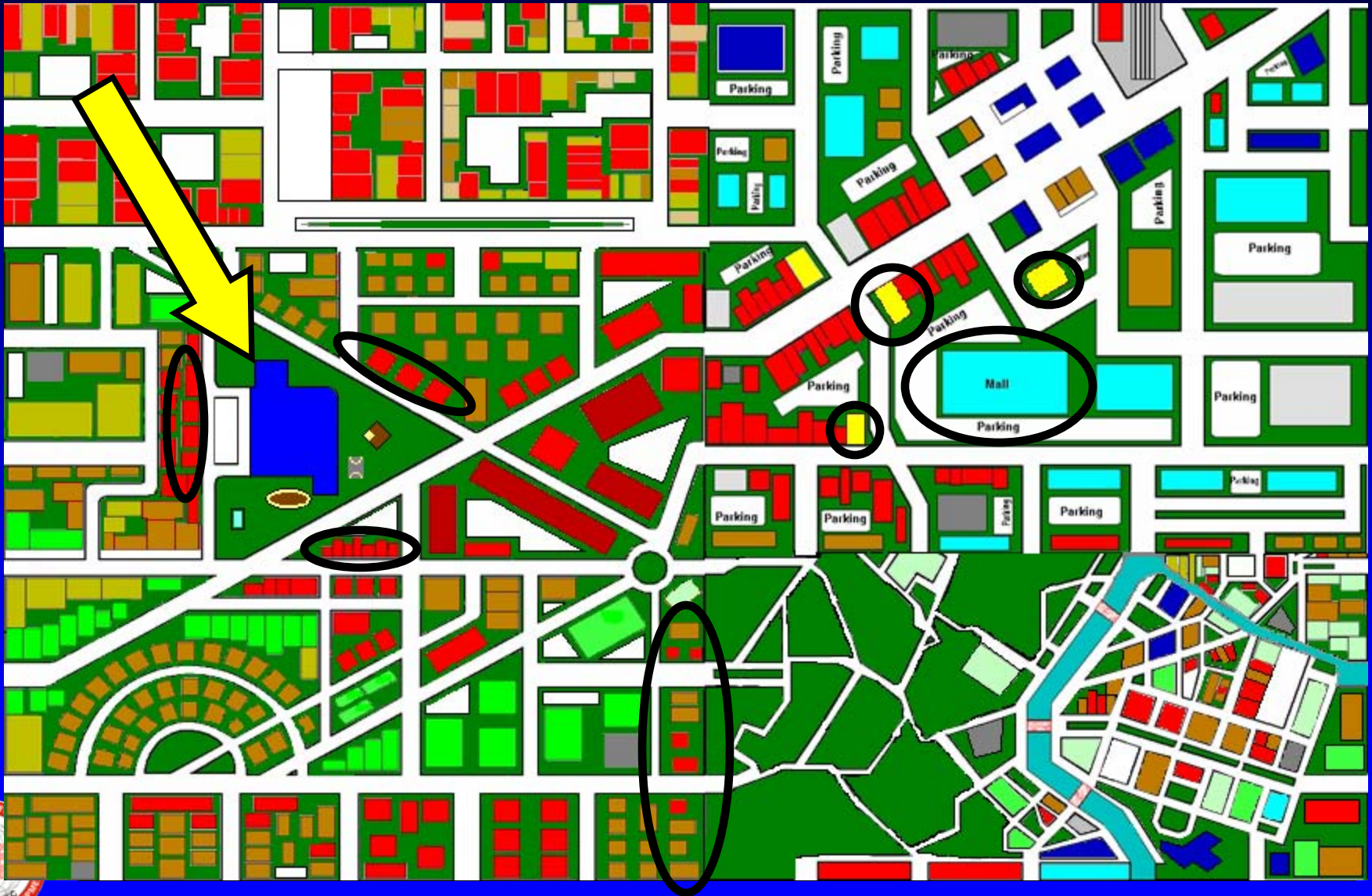
What is Geo-Cultural Analysis?

Understanding the relationship between

- Cultural influence on human behavior
 - Religion calls for collective prayer/gathering of the community
- Physical manifestation of culturally influenced human practices
 - Mosque
 - Synagogue
 - Church
- Temporal manifestation of human behavior
 - Holy Day—Friday; Congregational Prayer begins at noon
 - Sabbath—Friday evening to Saturday evening; Temple on Saturday
 - Day of Worship—Sunday; Services in morning
- Spatial organization of culturally influenced human practices and their byproducts
 - Faithful transverse habitual pathways from home/work/school to mosque/temple/church
 - Support structures (roads, parking, meeting halls, academies, day care)



What is Geo-Cultural Analysis?



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Map Source: AMSAA UTTs

Geo-Cultural Analysis & Modeling

- Time-Geography Axiom: “the movements of an individual are restricted by the location in time and space of fixed points which must be respected”
- Time-Geography Benefits:
 - Creates a “closed” system
 - Provides constraint structures for describing behavior types (authority, capability, coupling)
 - Accounts for movement/behavior of people in the built environment
- Ontology Benefits:
 - Relationships become more robust
 - Not restricted to 3D “axis” structure
 - More variables for relationship analysis
 - Cyclical, iterative modeling of time geography
 - Inferencing ability in data poor environment



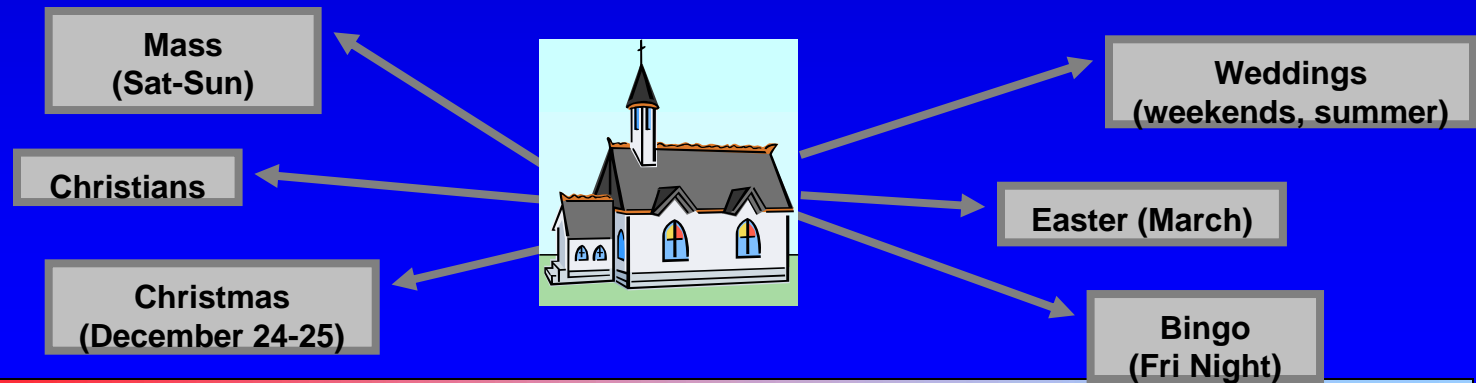
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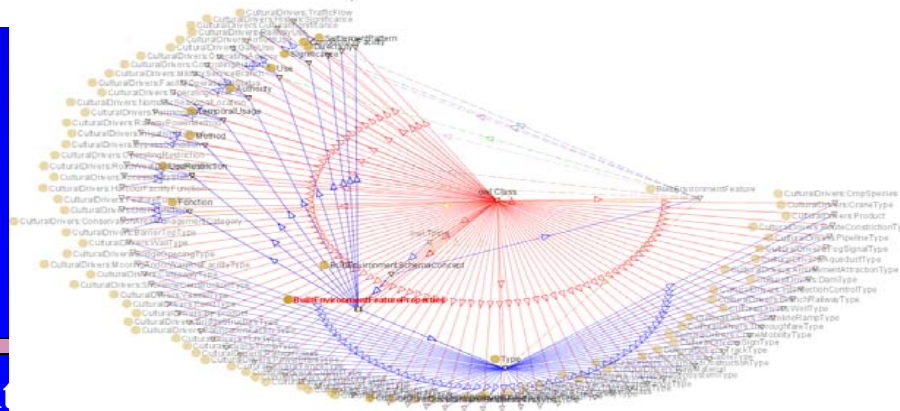
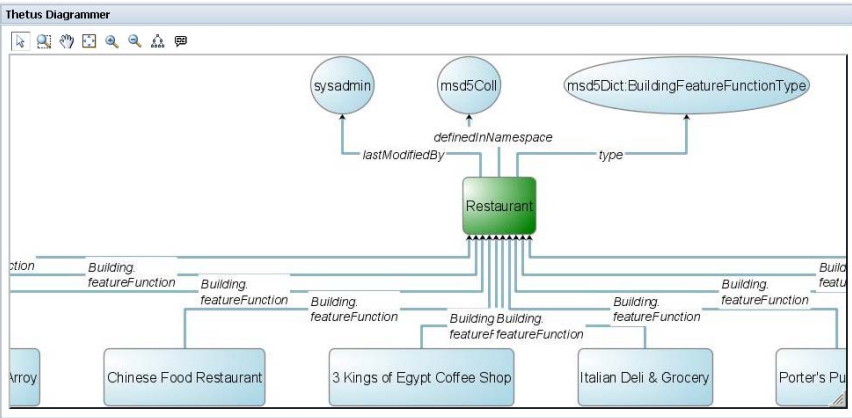


Geo-Cultural Ontology

- What is Ontology?
 - Taxonomy on steroids
 - Design to answer specific “questions”
 - Emphasizes relationships/inferencing analysis
 - Allows multiple attribution layers
- How can we use Ontology?
 - GCA application method
 - GCA + Geo Database Model + Ontology = Socio-Cultural & Temporal Attribution of Feature Entities



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Geo-Cultural Ontology

Culture
WHO

WHAT

Shopping
School
Work
Sports
Worship
Leisure
Eating
Parades
Exercise
Touring
Etc.

WHEN

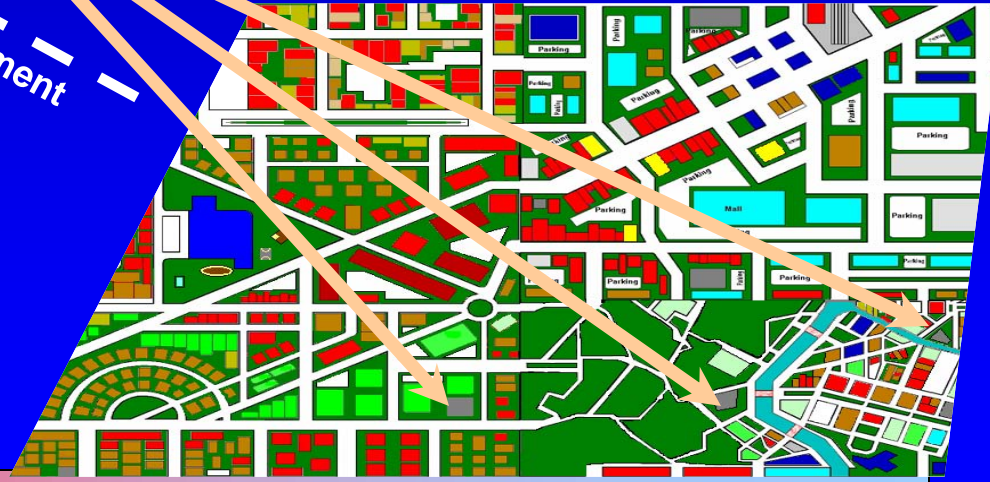
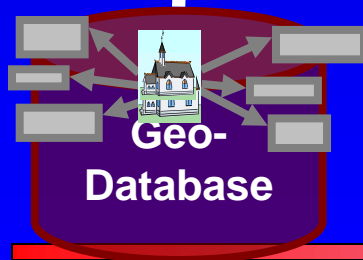
Time
Day

1 2 3 4 5 6 7 8 9 10 11 ... n...24

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 ... n...365

WHERE

Urban Built Environment



Geo-Cultural Ontology

Weekday:

0000 – 0500

0500 – 0800

0800 – 1130

1130 – 1330

1330 – 1530

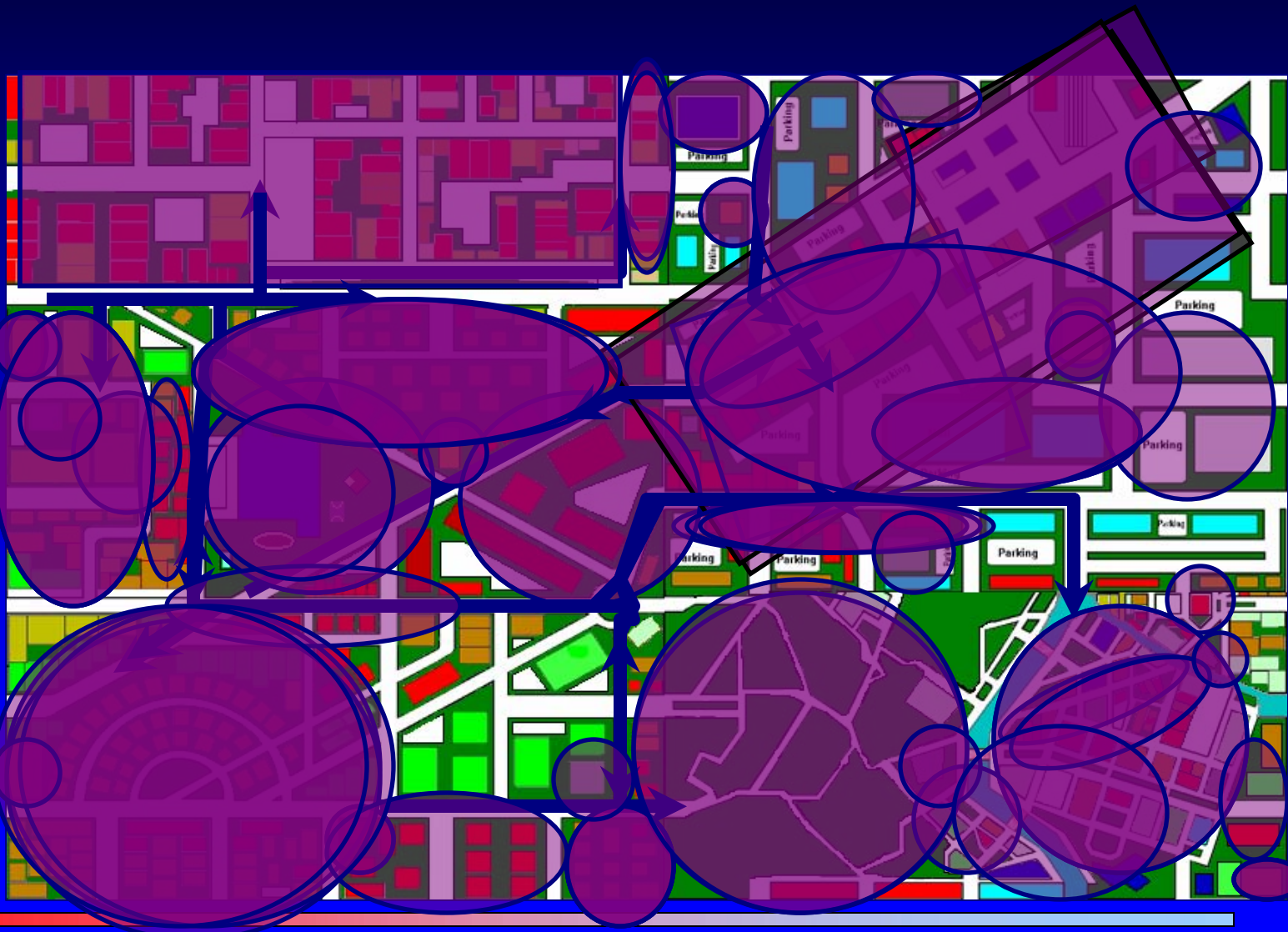
1530 – 1700

1700 – 1930

1930 – 2200

2200 – 2400

**Map Source:
AMSAA UTTs**



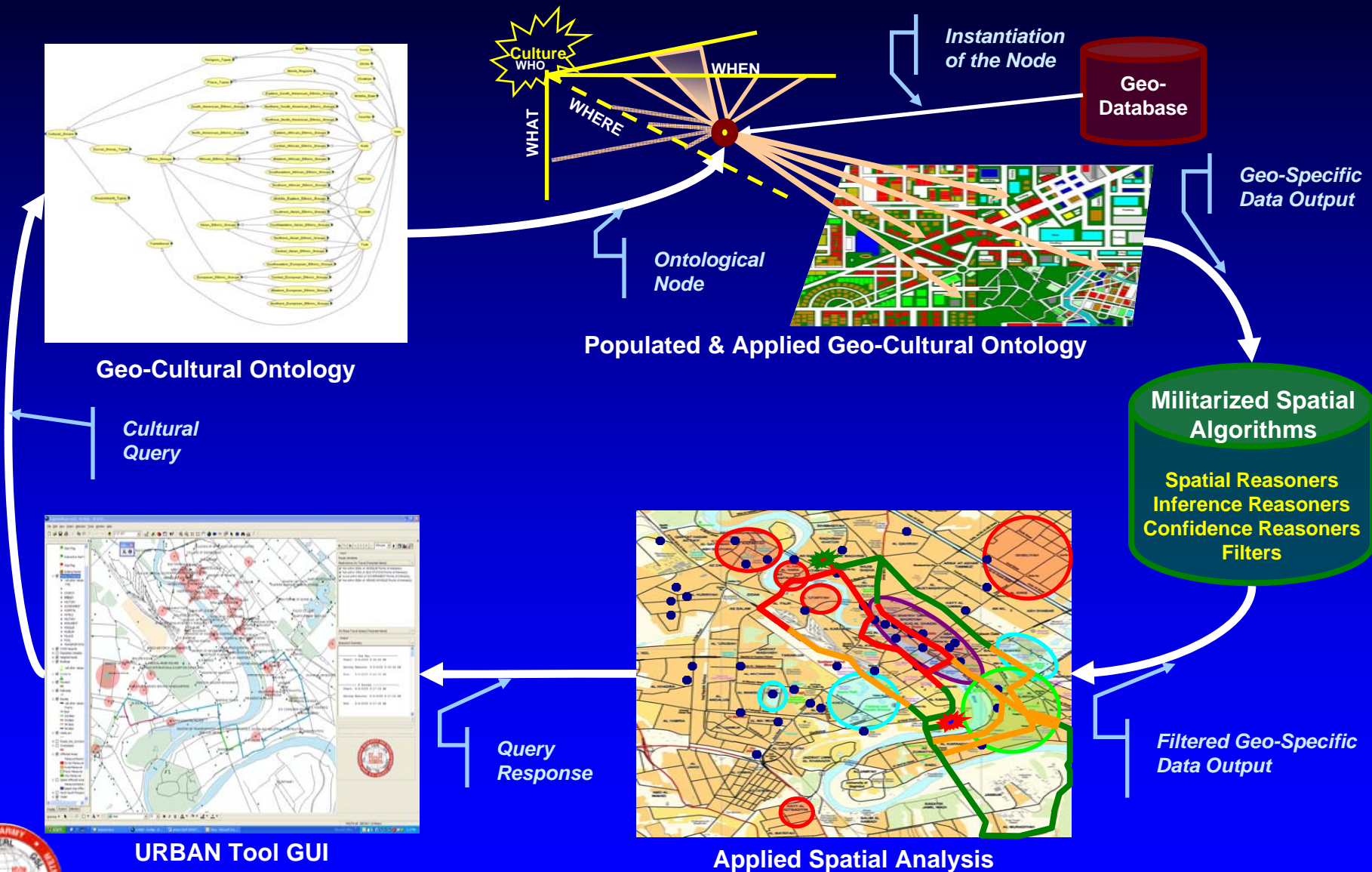
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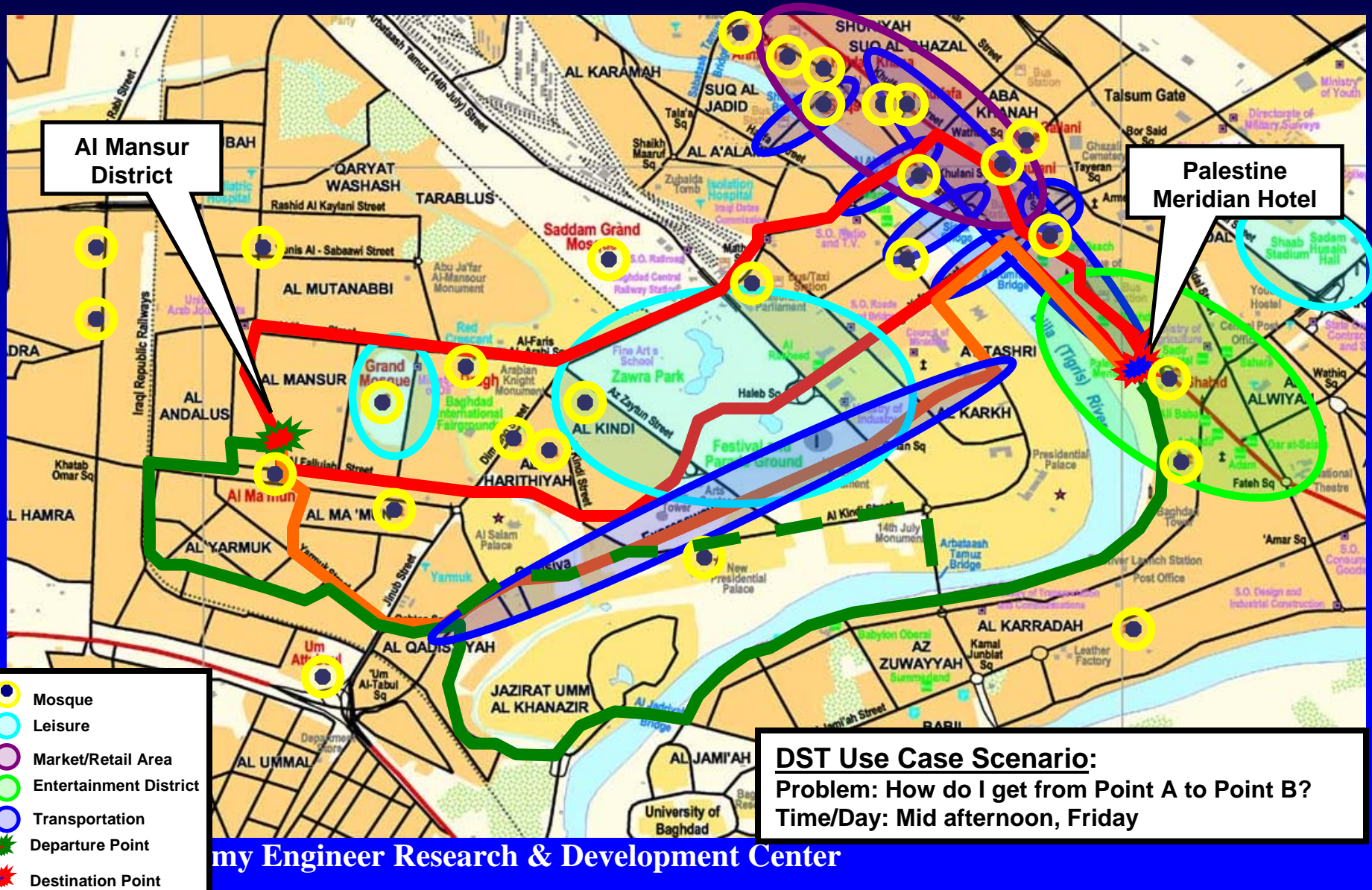
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Geo-Cultural Characterization for URBAN



Mission: Route Planning



GCAT Prototype v.0.5

ERDC  **GEO CULTURAL ANALYSIS** 

Welcome back Default System Admin. You're using the default personality. [Change personality](#) [Logout](#)

<http://192.168.115.20/MissionPortlet/resour> [Load BML](#)

[Test Scenario Baltistan](#) [Load Mission](#)

Min Time 00:00
Max Time 00:00

Mission Name: None Loaded

2D 3D



Road
Aerial
Hybrid



Microsoft® Virtual Earth™

0:00 3:00 6:00 9:00 12:00 15:00 18:00 21:00 24:00



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GCAT Prototype v.1.0 (Mockup)

Toolbar Functionality: Export (XML, Flat file/report, ESRI); Display Option (2D/3D view, ArcMap, Expand/Contract Links); Back Button; Save View/data Button; IPB Only Toggle Button; Search Box.

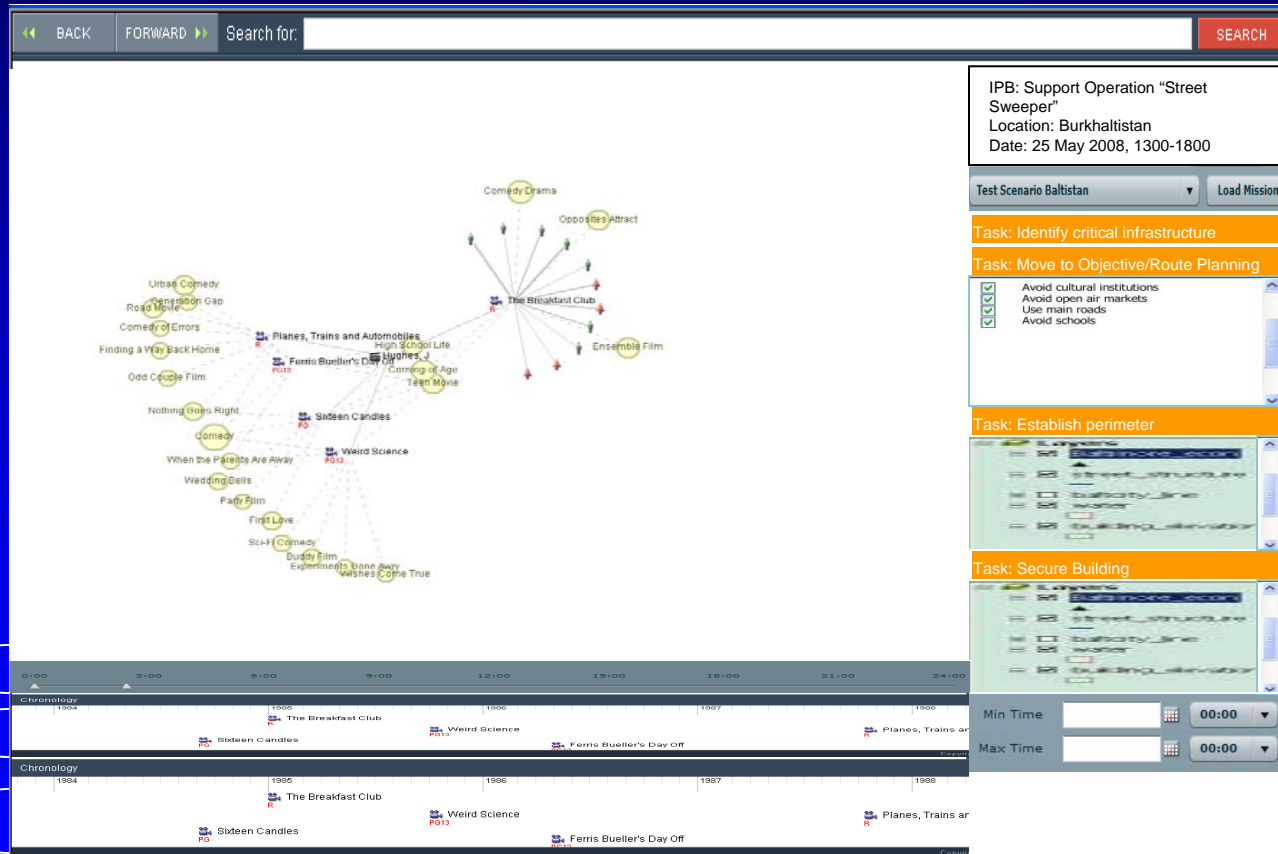
Toolbar

Display Area:
"Bubble"
diagrams
or Map of
GCO

mission
summary text

Task w/
interactive
filters
(automatically
provided
based on
Mission Type)

Modify
timeline/date



Inferencing Analysis

- With ontology, have rich machine readable mechanism for behavior/activity expression
 - Use specific behavior/activity if available
 - Fall back to use next 'closest' behavior/activity when not available
- *Making data out of nothing at all (sort of)*



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Future GCAT Development

- **GCAT Functionality:**
 - Open Source Migration (Protégé & Relational db)
 - Cultural Nearness Mapping
 - ThinkMap Application Development
 - ESRI ArcGIS interactive
- **Expanded decision support applications/capabilities:**
 - STTR
 - Sensor placement optimization
 - Human Terrain Team support
- **Training**
 - More realistic training environments
 - Improved behavior sets for role players
- **Modeling & Simulation**
 - Culturally informed behavior sets, built environment and temporal data
 - Rapid characterization of geo-typical to geo-specific UBE
 - Realistic inputs to crowd and mobility models



GCAT & Roadmap to Success for 2020

- **Models and simulations are pervasive in our everyday lives. They are used to reduce cost, analyze alternatives, reduce environmental impact, improve training, conserve resources and save lives.**
- **Modeling and Simulation (M&S) helps us:**
 - **analyze situations and predict outcomes**
 - **consider "trade offs" in allocating time and resources**
 - **make smarter decisions**
- **GCAT offers:**
 - **Realistic population information**
 - **Customizable formats for input to modeling**
 - **Flexible and updatable knowledge base for varied applications**



Geo-Cultural Analysis Tool™

Putting People Back in the Picture



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Putting Socio-Culture in its Place on the Map

It's Ten O'clock. Do you know where the people are?



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